REMARKS

The application is believed to be in condition for allowance.

Claims 1-34 were examined and remain pending.

There are no outstanding formal matters.

Rejections Under 35 USC 102, 103

Claims 1, 2, 5, 8, 10, 12, 13, 15-22, 24, 33 and 34 were rejected under section 102 as anticipated by ISHIHARA 2001/0050815.

Claim 11 was rejected under section 103 as obvious in view of ISHIHARA.

Claims 3, 4, 14, and 25-32 were rejected under section 103 as obvious in further view of SUZUSHI 2002/0110651.

Claims 6 and 7 were rejected under section 103 as obvious in further view of NIKOLOV 2004/0095637.

Claim 23 was rejected under section 103 as obvious in further view of KNOP 4,251,137.

Claims 1 and 21 are novel and non-obvious

Certain ISHIHARA disclosure offered by the Official Action is incorrect. As a result, the claimed invention is neither disclosed nor rendered obvious. The structure and operation of ISHIHARA is fundamentally different from the present invention, as disclosed and as recited.

As an initial matter, applicant would like to point out two distinctions between ISHIHARA and the pending independent claims.

First, the claim 1 requires both the predetermined diffracted first image and the predetermined polarized second image to vary spatially over at least part of the overall image. See the recitation "thereby to produce a predetermined polarized second image when illuminated in use so that both a diffracted [first] image and a polarized [second] image are viewable in which both the diffracted image and the polarized image vary spatially across at least part of the overall image".

In ISHIHARA, one of the principal aims is to ensure that the ISHIHARA device provides a uniform output field. The concept therefore of providing an image which varies spatially as opposed to being uniform runs completely contrary to the teachings of ISHIHARA. Put another way, ISHIHARA teaches away from the present invention.

Second, in ISHIHARA alignment of the liquid crystal material is achieved by an orientation film 34a which is different and spaced from the surface which provides the diffractive pattern 32a. It is clear that in ISHIHARA, the liquid crystal material is orientated by the orientation film rather than the diffraction pattern. Clearly, if the diffractive pattern were capable of or recognized to be capable of orientating the liquid crystal film there would be no point in having a separate orientation film.

These and other differences are discussed below.

To the extent that the Examiner may disagree with any point raised in these Remarks, or statement as to the claimed invention, applicant respectfully requests a specific finding of fact tied to identified disclosure of ISHIHARA.

ISHIHARA (Figure 1) discloses a device comprising a first substrate (32) having a micro-relief pattern (32a) which diffracts light and an optically anisotropic layer (33) of liquid crystal material located (or sandwiched) between the first substrate and a second, entirely separate, substrate (34) on which a layer of an 'orientation film' (34a) is provided. Substrates 32 and 34 are held together by a sealant (35).

However, and crucially, ISHIHARA does not disclose a device which provides a polarized image and a diffractive image from the same relief structure. Again, note the recitation that

"the diffracted image and the polarized image vary spatially across at least part of the overall image".

An image contains some pattern or information. The meaning of image is discussed on page 9, lines 1-15 of the specification, and as illustrated in the examples. ISHIHARA's devices are not producing an image but a uniform output.

The Official Action refers to paragraph (0005) which does mention "an image", but in the context of the image being formed by a separate liquid crystal display device (LCD), which is a well known device for spatially modulating light to represent an image, and is completely different to the device in as claimed.

The LCD needs a uniform light source with the correct polarization (a backlight) and the ISHIHARA device is a device for producing that uniform light source and is behind the LCD. The ISHIHARA device itself produces a uniform output.

The Official Action also refers to paragraph (0090) which refers to separation of the light into two linearly polarized light components, but each linearly polarized output is uniform, i.e., there is no image.

Indeed, throughout the specification ISHIHARA stresses again and again the requirement to prevent any disturbances or variation of the polarization. When ISHIHARA is read in its entirety, it is clear that ISHIHARA avoids any variations.

ISHIHARA rubs the 'orientation film' 34a which is located on the second substrate 34 (different from the first substrate 32 which contains the diffractive pattern 32a) with which liquid crystal material is brought into contact to align the LC materials. In paragraph (0087) ISHIHARA states that the LC materials are orientated homogeneously along the rubbing direction (on 34a) which has been chosen to be parallel to the direction of the grooves of the diffractive grating surface (32a), so it would appear that, in the ISHIHARA device "the liquid crystal material located over the surface has an orientation along the grooves". The grooves on 32a are not responsible for the alignment, as required in the pending claims.

ISHIHARA does not say whether the optical axis is 'parallel to surface'. In principle, the LC molecules can align along the grooves, but not necessarily parallel to the surface. They can have an angle different from zero with respect to the surface (in the z axis), even in a direction vertical to the surface, while still being aligned with the grooves, the grooves only defining a uniform direction in the x-y plane. However, for the device to work, ISHIHARA needs the molecules to be parallel to the surface throughout the thickness of the film.

In paragraph (120) ISHIHARA discusses about the control of thickness and says that if it is too thick 'the orientation of the molecules becomes increasingly random'. So, although ISHIHARA does not say it, one may understand that the molecules

are parallel to the surface. However, this is done by the alignment layer 34a and not by the grooves 32a or by the surface containing the grooves 32. Nowhere in the ISHIHARA specification is it disclosed that the grooves are playing any role in the alignment process.

See that pending claims 1 and 21 specifically require that "the micro-relief pattern induces local orientation of the optical axis of the optically anisotropic layer". Thus, the mere local orientation of the optical axis of the optically anisotropic layer is insufficient to anticipate this recitation. To anticipate the recitation, there must be disclosure of the micro-relief pattern inducing the local orientation of the optical axis of the optically anisotropic layer. ISHIHARA does not make this disclosure.

In ISHIHARA, the orientation of the optical axis is not induced by the micro-relief pattern but the orientation of the optical axis is obtained by the rubbing process on an entirely separate substrate 34 on which an alignment layer 34a is provided (the rubbing process is unidirectional by definition and so are the gratings). See paragraphs (0087) and (0130). It is clear from the present specification (page 8, lines 8-10), and as required by the claims, that the micro-relief pattern acts also as an alignment surface to align the optically anisotropic layer to provide a phase modulating structure.

Furthermore claims 1 and 21 require that "to align the local optical axis at respective orientations corresponding to the predetermined spatial distribution of said micro-relief pattern to impose a predetermined spatial distribution of polarization modulation".

In ISHIHARA, although when the LC layer is aligned by rubbing the resulting orientation of the optical axis may be such that the optical axis is oriented relative to the micro-relief pattern, there is no "micro-relief pattern induces local orientation" so that "alignment at respective orientations corresponding to the predetermined spatial distribution of said micro-relief pattern" as required by the claims because in ISHIHARA there is not a predetermined spatial distribution of said micro-relief pattern (it is unidirectional), and there is only one orientation of the optical axis of the LC layer. ISHIHARA has a unidirectional grating to provide the uniform output required in his application. The use of the phrase 'respective orientations' in the claims is because there needs to be more than one--there is not just one single orientation across our whole device, but a plurality of orientations to enable the production of the required pre-determined image, (for example simple two tone images or complex grey scale images, as in Figures 5 or 7). The spatial distribution of the orientation of the optical axis matches the spatial distribution in the

underlying encoding surface (See specification page 21, lines 2-9).

A further requirement of the claims is "to impose a predetermined spatial distribution of polarization modulation". The ISHIHARA device does not modulate the polarization.

In particular, ISHIHARA does not result in a spatial distribution of polarization modulation. Polarization modulation is about changing the direction (i.e., rotation relative to the optical axis) of the polarization or changing the amplitude type of the polarization (for example, the present invention can illuminate the device with linearly polarized light in a particular direction, and the output can be linearly polarized light in plurality of directions, or the output can be circularly polarized light).

Spatial distribution of polarization modulation requires that the polarization will be changed in different ways in different parts of the device (as shown in the disclosed examples). These different parts will be viewed as different densities (e.g., bright or dark) when viewed through a polarizer. Furthermore, this spatial distribution of the polarization modulation is pre-determined ("to impose a predetermined spatial distribution of polarization modulation"), correlating with the spatial distribution designed into the encoding layer. Page 23 illustrates by example. The ISHIHARA device merely separates the incident light into two linearly polarized components with

perpendicular polarization gratings (0087) and makes it very clear throughout that text that disturbance, i.e., modulation of the polarization is highly undesirable see paragraph (0091).

An additional feature required by claims 1 and 21 which is not present in Ishihara is "and wherein the orientations of the optical axis of said optically anisotropic layer are fixed".

The present specification discloses, for example, that once the anisotropic layer is aligned by the encoding surface, it is fixed, e.g., polymerizing the LC layer by UV curing so that it is a solid (rather than liquid layer). ISHIHARA does not do this. Indeed, ISHIHARA requires sealant (35) to keep the LC material between substrates 32 and 34. Thus, in ISHIHARA the orientations of the optical axis of said optically anisotropic layer are not fixed.

In view of these several noted differences, it is clear that both claims 1 and 21 are novel over ISHIHARA.

Claim 5

As to claim 5, the Official Action indicates that paragraph 0087 and Figure 1 disclose the recited subject matter. However, the recited subject matter is not found in ISHIHARA.

ISHIHARA paragraph 0087 (and elsewhere) does not disclose an encoding surface with a plurality (i.e., more than one) of areas that have a respective orientation of the micro-

relief pattern. All the discussion and examples in ISHIHARA have a single orientation of the micro-relief pattern.

If the Examiner disagrees, applicant respectfully requests a clearly annotated Figure 1 and paragraph 0087 showing the disclosed subject matter and an explanation of how the disclosure satisfies the claim recitation.

Claim 5 is clearly novel over ISHIHARA.

Claim 8

Claim 8 recites "wherein at least one of: the average thickness of the optically anisotropic layer, and its birefringence varies with position across said device to vary the optical retardation induced thereby".

Contrary to the Official Action's assertion, Figure 1 of Ishihara does not show the thickness of the anisotropic layer varying to vary the optical retardation induced by the layer.

Rather, ISHIHARA desires and desires a uniform thickness. See paragraph (0120) for discussion of problems if thickness varies.

Thus, ISHIHARA neither discloses or suggests the feature of claim 8. Indeed, ISHIHARA specifically teaches away from claim 8.

Claim 17

Claim 17 recites "wherein said optically anisotropic layer comprises a polymerisable liquid crystalline material fixed to a single substrate, and the polarized image is obtained through local polarization modulations on the single substrate, said anisotropic layer remaining always anisotropic".

The Official Action offers ISHIHARA paragraph (0117) as a disclosure of a polymerisable liquid crystal.

> [**0117**] As a second embodiment of the invention, **FIG. 5** shows, in a sectional view, a polarization separation device **2** having a diffractive optical element **40**. **FIG. 4** shows, in a sectional view, the process of forming the diffraction grating surface **37***a* of the diffractive optical element **40**. This polarization separation device **2** is provided with a diffractive optical element **40** of a composite, surface-relief type produced by forming on a glass substrate **36** a resin layer **37** having a diffraction grating surface **37***a* on its surface. A liquid crystal layer **33** is provided contiguously with the diffraction grating surface **37***a*. The liquid crystal layer **33** is made of nematic or smectic liquid crystal. An opposed flat plate **34** is provided contiguously with the liquid crystal layer **33** so that the liquid crystal layer **33** is sandwiched between the opposed flat plate **34** and the resin layer **37**. The opposed flat plate **34** is a transparent substrate made of resin or glass. On the liquid crystal layer **33** side surface of the opposed flat plate **34** is provided, as in the polarization separation device **1** described previously, an orientation film **34***a*, which has been subjected to a rubbing process so that the liquid crystal molecules are oriented homogeneously along the grooves of the diffraction grating surface **37***a*.

This recitation of "wherein said optically anisotropic layer comprises a polymerisable liquid crystalline material fixed to a single substrate, and the polarized image is obtained through local polarization modulations on the single substrate,

said anisotropic layer remaining always anisotropic" is not found. Where is there disclosure of a polymerisable liquid crystalline material?

If the Examiner disagrees, applicant respectfully requests a clear annotation of paragraph (0117) showing the disclosed subject matter and an explanation of how the disclosure satisfies the claim recitation, i.e., what is the polymerisable liquid crystalline material, to what single substrate is this material fixed, where is the disclosure that the polarized image obtained through local polarization modulations on this single substrate (onto which the polymerisable liquid crystalline material is fixed) and the anisotropic layer (comprising the polymerisable liquid crystalline material) remaining always anisotropic.

Although applicant has addressed these specific claims and discussed why these claims are patentable, the remaining claims are also believed to be patentable, at least for depending from a patentable claims.

Reconsideration and allowance of all the claims are respectfully requested.

Should there be any matters that need to be resolved in the present application; the Examiner is respectfully requested to contact the undersigned at the telephone number listed below.

The Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 25-0120 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17.

Respectfully submitted,

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